

This document was submitted to EPA by a registrant in connection with EPA's evaluation of this chemical, and it is presented here exactly as submitted.

Benefits of Def/Folex (tribufos) in Cotton

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In this discussion, it is important to remember that the cotton plant is a perennial. Its nature is to maintain growth from year to year. However, long-established cultural practices treat cotton as an annual crop in order to maximize production of quality fiber. Cotton seeds are planted in the spring, the crop matures through the summer and finally produces bolls (seed pods) which open in late summer and early fall. Prior to mechanized harvest, plants were “terminated” by the first killing frost. Today the industry relies on chemical harvest aid products to prepare the crop for harvest.

Older cotton varieties typically required at least 220 days for maturation, but today’s cotton varieties mature in 140 to 180 days. This shortened growing season reduces weather related yield and quality losses, allows harvest in more favorable weather and reduces losses to late season insect pests. Even in low rainfall west Texas, research indicates that the field weathering losses resulting from delayed harvest frequently exceed \$5/bale/week, about 2% of the value of the crop (Williams, 1984). Given short-season varieties and the importance of timely harvest to preserving crop value, we must rely on something other than frost to help “terminate” and prepare the crop for harvest.

Role of Harvest Aid Products in Getting Crop Ready to Harvest

Crop yield and quality are at high risk during the time the mature crop is in the field awaiting harvest. With weather and crop condition (growth stage, maturity, senescence, etc.) difficult to either predict or evaluate, effective preparation of cotton for harvest is critically important to maintaining crop value. This entails effective removal of leaves, retardation of regrowth, and promotion of boll opening in order to achieve timely harvest. Chemical harvest aid products such as defoliant, desiccants, and boll openers like Prep (ethephon) are essential in achieving these objectives. Harvest preparation must be carefully scheduled to coincide with availability of harvesting equipment and a favorable 10 to 14 day weather outlook. Cotton harvest in the U.S. is highly mechanized with large farms and limited harvesting capacity (especially pickers).

Additionally, the harvest window (September and October in the mid-south) is short and weather during this period is highly variable and very unpredictable.

Prior to ginning, harvested cotton is held in high-density modules for a few days up to a few months in the field or on the gin yard. To preserve quality during storage in modules, seed cotton must be kept at low moisture levels and monitored closely. Excess leaf and plant trash, especially green leaves, are detrimental to crop quality. Severe discounts are applied to ginned lint which suffers from inordinate amounts of leaf trash, or stains caused by green leaf trash or high moisture conditions during storage. For example, in 1999 a bale of 4134 cotton with a leaf grade of 7 suffered a discount of 8.3 cents/lb. relative to the base grade of 4134, leaf 4, or approximately \$40/bale (USDA Loan Schedule). Similarly, the discount for stained cotton grading 4334, leaf 4 was 8.3 cents/lb. Effective harvest preparation with harvest aid chemical products including defoliants, desiccants, and boll opening agents is critical in preserving the quality of the cotton and avoiding discounts such as those illustrated above.

The economic importance of delivering high quality lint only continues to increase. As explained in the publication *The Science and Art of the Cotton Harvest* (ATTACHMENT 1), “recent changes in the classification system for fiber evaluation have placed greater emphasis on harvesting cotton free of trash and color pigmentation. Trash, as measured by High Volume Instruments (HVI), is the non-lint material in a ginned cotton sample. HVI color or the classer’s grade is the degree of light reflectance and yellowness of the cotton fiber. Contact of the cotton fiber with grass or weeds and the cotton plant leaves are two of the several that can contribute to color variabilities.”

The potential for increased aflatoxin contamination of cottonseed must also be considered, particularly in the western cotton belt (southern California, Arizona and south Texas). Research has found a strong link between the length of the harvest delay and the extent of aflatoxin contamination. For example, a study in Arizona’s Yuma Valley found that a harvest delay from mid-September to late-October resulted in an almost 800% increase in aflatoxin concentration (ATTACHMENT 10). The aflatoxin level exceeded all thresholds for detoxification, rendering the cottonseed effectively worthless. Less extreme cases of aflatoxin contamination also have a deleterious effect on cottonseed value, resulting in a \$30-\$50/ton discount relative to uncontaminated cottonseed (Mr. Rick Lavis, Arizona Cotton Growers Association, personal communication).

Use of Def/Folex (tribufos)

Products based on the active ingredient tribufos have been used as a defoliant on cotton for over 40 years. The two products most widely used, Def and Folex, are for practical purposes identical.

Usage: The 1998 USDA ERS NASS survey “Agricultural Chemical Usage – 1998 Field Crops Summary -AG CH 1, 99 (ATTACHMENT 2)” estimated that about 30% of the cotton

acres in the U.S. were treated with tribufos for defoliation of cotton. Included in the references is a summary table that was developed from that report. However, remarks included below by Dr. Snipes from Mississippi State University (ATTACHMENT 3) and Dr. Steve Brown from the University of Georgia (ATTACHMENT 4) indicate that usage is actually higher than the USDA ERS NASS report estimates. Additionally, data from actual use of tribufos in California show that during 1984-1997, an average of 49% of California's cotton acreage was treated annually with tribufos (Annual Pesticide Use Reports 1993-1997 California EPA Department Pesticide Registration (ATTACHMENT 5)).

Rates: The USDA ERS NASS data indicates an average rate of 0.7-lbs. ai per acre is used and that typically, only one application per acre per year is used. Our estimates show that the typical use rates for most of the cotton belt range from 0.75 pt. to 1.5 pt. (0.7 to 1.2 lbs. ai per acre). However, cotton grown in the western states requires a higher rate of 1 1/3 to 2.5 pts. (1.0 to 1.87 lbs. ai per acre) to obtain effective defoliation (Uniform Harvest Aid Performance and Fiber Quality Evaluation Cotton Defoliation Work Group – Research Report (ATTACHMENT 6). These figures reflect recommended use rates because actual use rates will vary depending upon locality, season, crop condition, and use of mixtures.

Def/Folex has been used for cotton defoliation for over 40 years, however, the use of this product is evolutionary. Following cancellation and subsequent phase out of arsenic acid in the early 1990's, along with the availability of newer harvest aid products, a 5-year cooperative beltwide study was conducted to refine recommendations for cotton harvest preparation. This recently published study is included as an important part of The National Cotton Council's benefit statement for tribufos because it is current and because it represents the best overall evaluation of harvest aid products by the leading experts in the field. This publication identifies the importance of tribufos-based products because such products form two of the seven core treatments and several additional treatments applied as regional options. Further, it clearly shows that no one single product provides perfect preparation of the crop for harvest, i.e., defoliation, desiccation, regrowth suppression, and boll opening. Def/Folex (tribufos), for example, is an excellent defoliant, but is rated as only fair to poor in defoliation of new growth and in suppression of regrowth. Prep (ethephon) was the only product effective in opening bolls. The most effective use is to combine two or more of these products into mixtures with the idea that the desirable characteristics of each product will produce expected levels of crop preparation. Though there are alternatives to tribufos, the product's proven defoliation efficacy in warm as well as cool weather means that tribufos is often the product of choice in tank mixes.

Alternatives

We have studied the situation summary in The Agency's report "Transmittal of the Critical Site Benefits Screen for tribufos (Def)" (ATTACHMENT 7), and we think this is an accurate assessment of the products available for cotton harvest preparation. This document is actually

included to support our statement of benefits for tribufos. This document, however, does not include the use of tribufos as a mixture partner.

While, the report states that there are other products currently available, it should be noted that none of these products is entirely satisfactory, not even DEF/Folex! Each product is unique and is used under specific conditions. Producers need to make decisions on product mixtures that will work best under weather and crop conditions prevailing at the time of application. The trend is for more applications of products to be made in mixtures so that the best characteristics of each product will be combined to achieve effective crop harvest preparation. Producers need a selection of tools for crop harvest preparation.

Selected comments on Role of Def/Folex (tribufos):

C.E. Snipes, Plant Physiologist, Mississippi Agricultural and Forestry Experiment Station and Coordinator, Cotton Defoliation Work Group, Delta Research and Extension Center, Stoneville, Mississippi:

“Successful cotton harvest practices are largely dependent upon the use of harvest aids. The primary purpose of harvest aids are preservation of crop yield and quality produced during the growing season.”

“The number of suitable harvest aid materials for use on cotton is very limited”

“Tribufos, sold under the trade names of Def 6 (Bayer) or Folex (Rhone Poulenc Ag Co.), is a contact-type harvest aid material that is used on an estimated 70% of cotton acreage in Mississippi. About two thirds of this is by aerial application with the remaining application by ground equipment. It is considered an excellent, fast acting defoliant and is the preferred choice when temperatures turn cool during the harvest season”

“Use Rates in Mississippi range up to a maximum of 1.875 lbs. ai /acre, but actually seldom used above 1.125 lbs. ai /acre. It is typically used from 0.375 to 0.75 lbs ai /acre”

Dr. Billy E. Warrick, Associate Professor and Extension Agronomist, Texas A&M University, San Angelo, TX :

“Cotton produced in the Southern Rolling Plains of Texas is generally ready for harvest 30 days before the first killing freeze in the Fall. Due to the extra time that the cotton lint is exposed to weather, both yield and quality are reduced. Due to cool temperatures that occur in late-September and October when harvest aids are usually applied in the area, tests were initiated to determine the response of cotton conditioners, defoliants, and desiccants under cooler environmental conditions.”

“..... environmental conditions, maturity of the crop, variety of cotton and the management of soil moisture and nutrients are important variables that impact the performance of the harvest aid materials applied” (ATTACHMENT 8).

From the EPA’s document “Transmittal of the Critical Site Benefits Screen for tribufos (Def)”:

“Tribufos (Def) is the chemical of choice in certain geographical areas where thidiazuron (Dropp or Dropp Ultra) can not be used and cool temperatures limit the efficacy of Dropp.”

“In most cases, alternative products have limitations such as efficacy and/or cost.”

“One of the main advantages that Def has over other harvest aids is efficacy. It is not as temperature sensitive as Dropp---... Def is generally a better defoliant than Harvade---... It is a better defoliant than Ginstar in the “rainbelt” where Ginstar is “too hot”---...”

“Ginstar is much more expensive to use than Def and, because of its tendency to desiccate and stick to leaves under high humidity conditions, its use is largely restricted to the West and Southwest.”

Steven M. Brown, Extension Cotton Specialist, University of Georgia

“The compound (Def) is used on approximately 60 to 70 percent of the acreage in Georgia”

“Def and Folex are effective and economical. Alternatives that exist--- products such as Harvade and than presently used. It is quite possible that results will be far less consistent, with Dropp--- are not as effective across all conditions and will require higher application rates the outcome being increased cost and increased environmental exposure through increased pesticide use.”

California Cotton Ginners and Growers Associations

“In reviewing past defoliation studies, many of the alternatives identified by EPA have been inconsistent in their performance from year to year. Throughout the years, Def has remained one of the most cost effective defoliants used in California, according to not only the grower community, but also the University of California Cooperative Extension.”

Included as additional information is a selection of research reports from Proceedings, Beltwide Cotton Conferences (ATTACHMENT 8).

Summary and Conclusions

Tribufos is critically important to the U.S. cotton industry. Restricting the use of tribufos or removing the product altogether would obviously create a huge void in our industry's ability to prepare the crop for timely and efficient harvest.

Def/Folex is one of several harvest aid products used alone or in combination with other products to achieve effective preparation of the crop for harvest. Even with available tools, undesirable or incomplete defoliation and crop preparation often occurs. Producers need flexibility through product choices so that the most effective treatments can be put together to achieve effective defoliation under the crop and weather conditions at the time of application. Dr Snipes of Mississippi State University, an authority on cotton defoliation, states in his letter to the docket OPP- 34148B (ATTACHMENT 3) that “The number of suitable harvest aid

materials for use in cotton is very limited”. Removing or severely limiting use of tribufos would certainly bring hardship on our industry and result in higher production costs and an increased probability of lower lint prices due to reduced quality.

The cotton industry has met with EPA and the registrant (Bayer) and has discussed ways to mitigate FIFRA risks identified by The Agency’s revised risk assessment. We are submitting this statement of benefits as part of the continuing dialogue to preserve the usefulness of the defoliant products Def and Folex based on the active ingredient, tribufos. The National Cotton Council is confident that the overall benefit of tribufos to the cotton industry is extremely high and that this benefit will by far outweigh any risks of using the product.

Attachments

1. The Science and the Art of Cotton Harvest - The Cotton Defoliation Work Group Cotton Incorporated and Uniroyal Chemical Company.
2. USDA ERS National Agricultural Statistics Service - Summary of Tribufos use on Cotton in the US
3. Dr. Charles Ed Snipes letter to Docket OPP-34148B
4. Dr. Steve Brown Letter to Docket – 34148B
5. Annual Pesticide Use Reports 1993-1997 California EPA Department of Pesticide Registration – Summary of tribufos use in California.
6. Uniform Harvest Aid Performance and Fiber Quality Evaluation, Cotton Defoliation Work Group Research Report - 1992-1996 Mississippi State University Information Bulletin 358, September 1999.
7. Transmittal of the Critical Site Benefits Screen for Tribufos (DEF). EPA memo from Kathy Davis and Kathlene Depukat to Betty Shackleford (undated)
8. Selection of research papers from Proceedings, Beltwide Cotton Conferences
9. Williams, O.H. 1984. In-field Weathering Losses of Cotton. Summary Proceedings Western Cotton Production Conference, pp. 28-29 (document not available).
10. Cotty, P. 1989. Influence of Harvest Date on Aflatoxin Contamination of Cottonseed. Proceedings Beltwide Cotton Production Conference.